

News from the Savannah River National Laboratory

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BIOENERGY COLLABORATIVE PAVES WAY FOR FREEDOM FROM FOSSIL FUELS



New fermenters for bioenergy research at SRNL.

NORTH CHARLESTON, S.C. — Reducing the nation's dependence on fossil fuels will require the development of new energy sources, with the greatest interest in those that are clean, domestically produced, and economically advantageous. A collaboration of South Carolina research institutions and industry is paving the way to meet those requirements by advancing the development and commercial production of the next generation of biofuels: fuels made of cellulosic material (stems, wood, leaves, etc.) from non-food crops.

The South Carolina Bioenergy Research Collaborative has reached a new milestone toward that goal, completing key plans for a pilot plant to test and demonstrate methods to convert regional crops into clean, locally produced biofuels.

Last year, the U.S. Department of Energy's Savannah River National Laboratory (SRNL), Clemson University, South Carolina State University/James E. Clyburn University Transportation Center, and SC Bio (a not-for-profit organization that works to develop new life science companies) formed the South Carolina Bioenergy Research Collaborative to demonstrate the economic feasibility of using cellulosic biomass from regional plants, such as switchgrass, short-rotation trees and sorghum, to make ethanol. The research collaborative has expanded to include key industrial partners: Fagen Inc., one of the nation's leaders in designing and constructing ethanol plants; Dyadic International Inc., a leader in the development of novel enzymes for breaking down cellulose; and Spinx Corp., one of the leading distributors of biodiesel and ethanol gasoline blends in the South.

"We're focusing our efforts on biofuels that use locally available feedstocks that do not compete with food supplies," says SRNL Bioenergy Manager Tom French. "The goal is to use South Carolina's agricultural resources to help the state and nation reduce dependence on fossil fuels and enhance South Carolina's alternative-fuel industry."

Part of the research collaborative's mission is to establish a biofuels research pilot plant at the Clemson University Restoration Institute in North Charleston, S.C. Key design documents for that pilot plant are now complete, including the process flow diagram for the first phase of the research facility, which outlines how various equipment like fermenters and distilling columns will work together. The completion of those plans, along with layout drawings for both the first and second phase of the pilot plant, is a key step in preparing the facility for research activity.

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SRNL and Clemson are both in the process of installing new research facilities at their home laboratories that will be used to define the detailed operating parameters for the pilot plant. These research facilities, which should be operational this summer, will be used to determine the hydrolysis and fermentation operations, two of the major steps in producing cellulosic biofuels.

The pilot plant is designed to scale up new biofuel technologies, a crucial step between small laboratory experiments and full-scale production. In addition to the S.C. Bioenergy Research Collaborative's own research projects, it is envisioned that the pilot plant would become a user facility that would enable energy producers interested in energy crop bases in the Southeast to scale up new and innovative processes and ultimately build regional ethanol production facilities.

The U.S. Department of Energy has found that existing biofuels have already had a positive impact on the nation's economy and environment, with even greater benefits expected from future fuels. DOE scientists estimate that 13 million tons of greenhouse gases were avoided in 2007 due to biofuels production and use. The next generation of cellulosic biofuels from non-food sources, like the ones that are the focus of South Carolina's research initiative, promise even more significant reductions in greenhouse gas emissions – reductions of more than 86 percent compared with gasoline.

On the economic front, DOE estimates that current gasoline prices would be 20 cents to 35 cents per gallon higher without ethanol, a first-generation biofuel. For a typical household, that means saving about \$150 to \$300 per year. (See Fact Sheet: **Gas Prices and Oil Consumption Would Increase Without Biofuels**, at www.energy.gov.)

Regionally, research at the research collaborative's pilot plant could lead to significant economic development. South Carolinians consume over 2.5 billion gallons of gasoline every year, all of which is imported from out of the state. Producing enough cellulosic ethanol to replace just 20 percent of the state's gasoline usage would create thousands of new jobs and add \$2 billion to the local economy, according to the report "Breaking the Biological Barriers to Cellulosic Ethanol" produced by the U.S. Department of Energy in June 2006.

Among the technical challenges being addressed by the research collaborative are the development of energy crops with high fuel yield per acre, low water consumption and the ability to grow on less fertile lands. Other research will seek to identify cost-effective ways to break down the plants and produce an efficient fuel. Each of the various partners on this project brings existing technology that can be expanded into this field, including novel conversion enzyme targets and chemical technologies to convert residual and row crops into ethanol.

SRNL is the applied research and development laboratory at the U.S. Department of Energy's Savannah River Site. The Laboratory puts science to work supporting DOE and the nation in the areas of energy security, national and homeland security, and environmental management, including serving as the DOE Office of Environmental Management's corporate laboratory, supporting engineering and technology for cleanup and waste management across the DOE complex. The Laboratory is operated for DOE by Washington Savannah River Company, a subsidiary of the Washington Division of URS Corporation.